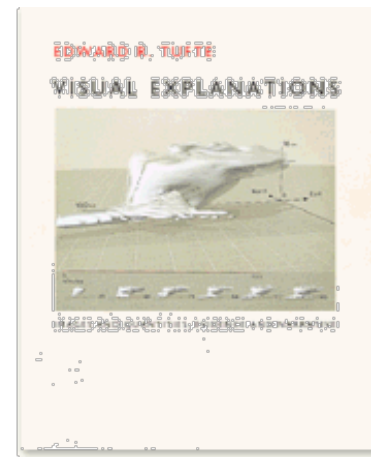
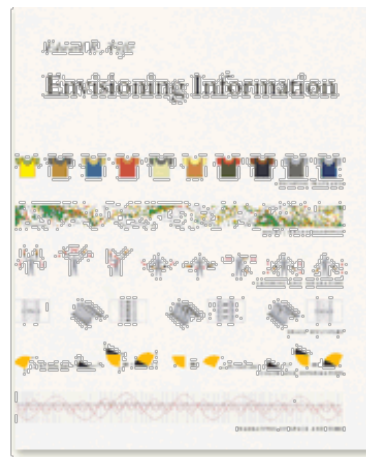
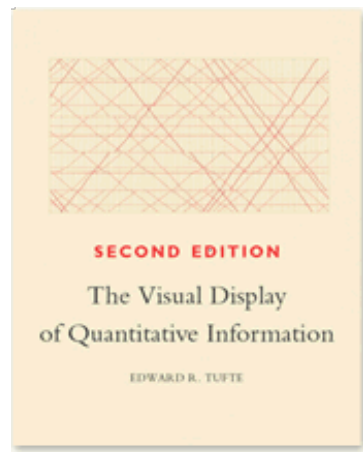
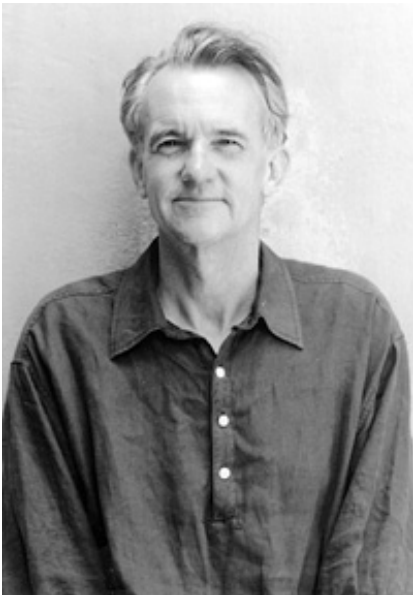


# Data Visualization

Edward Tufte

Pioneer of Data Visualization

Loves data-dense, minimalistic visualizations



## Tufte Principles

**Above all else, show the data.**

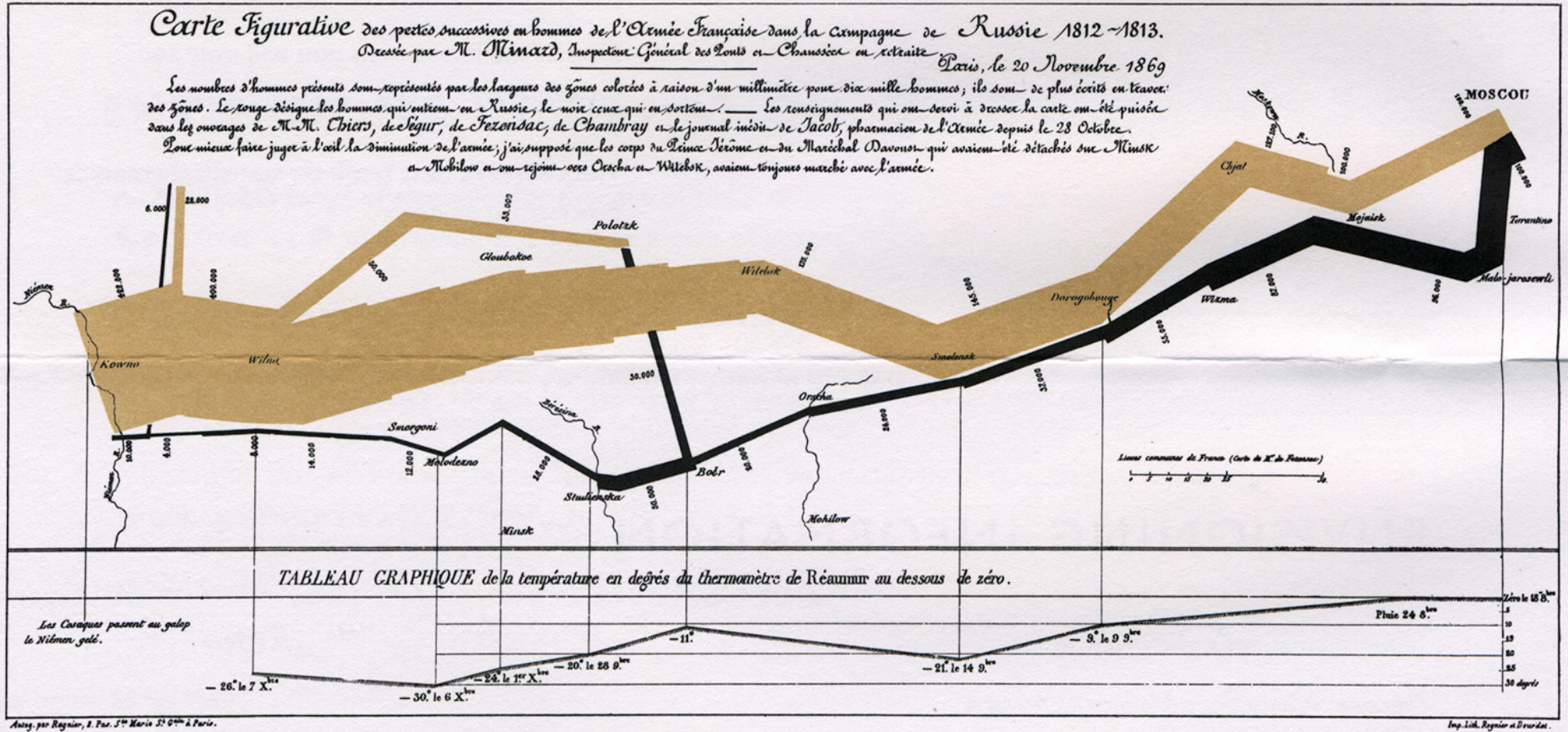
Maximize the data-ink ratio.

Erase non-data-ink

Erase redundant data-ink.

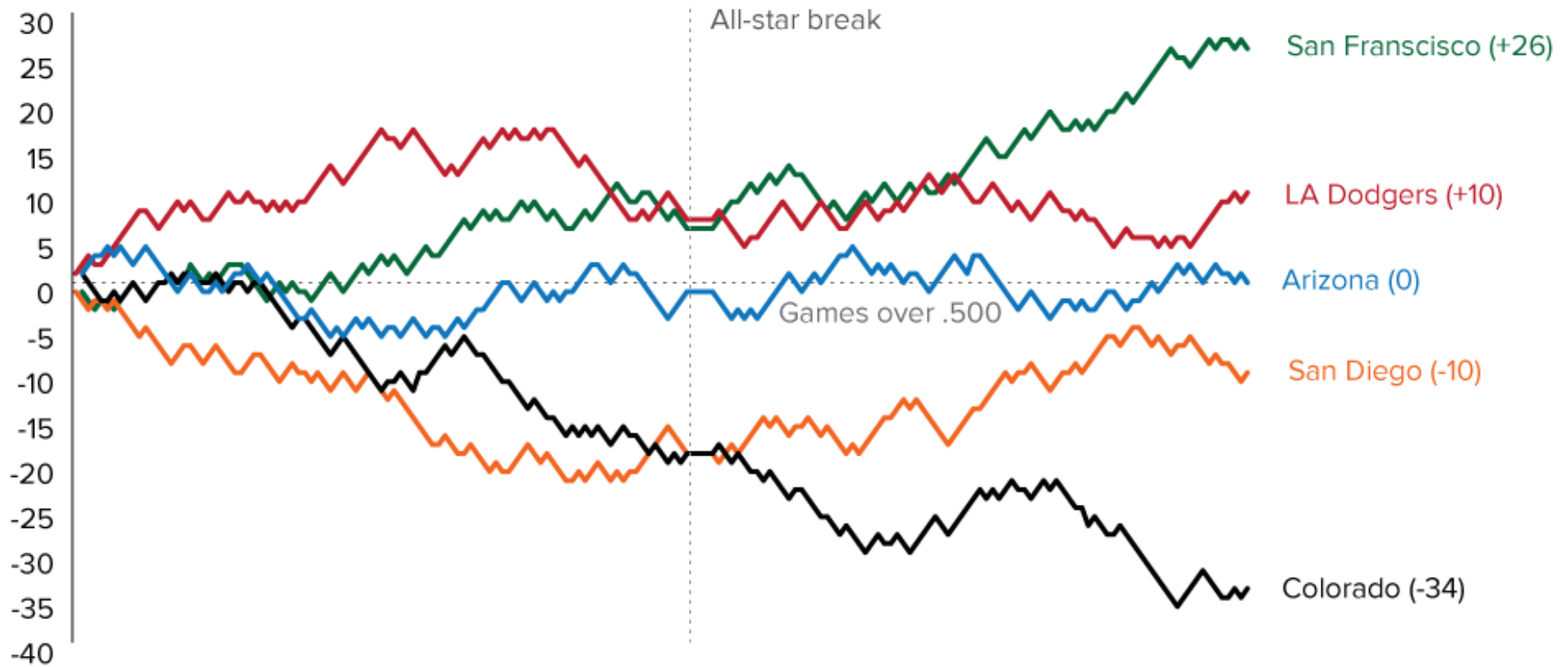
Revise and edit

# Some of Tufte's Favorite Visualizations

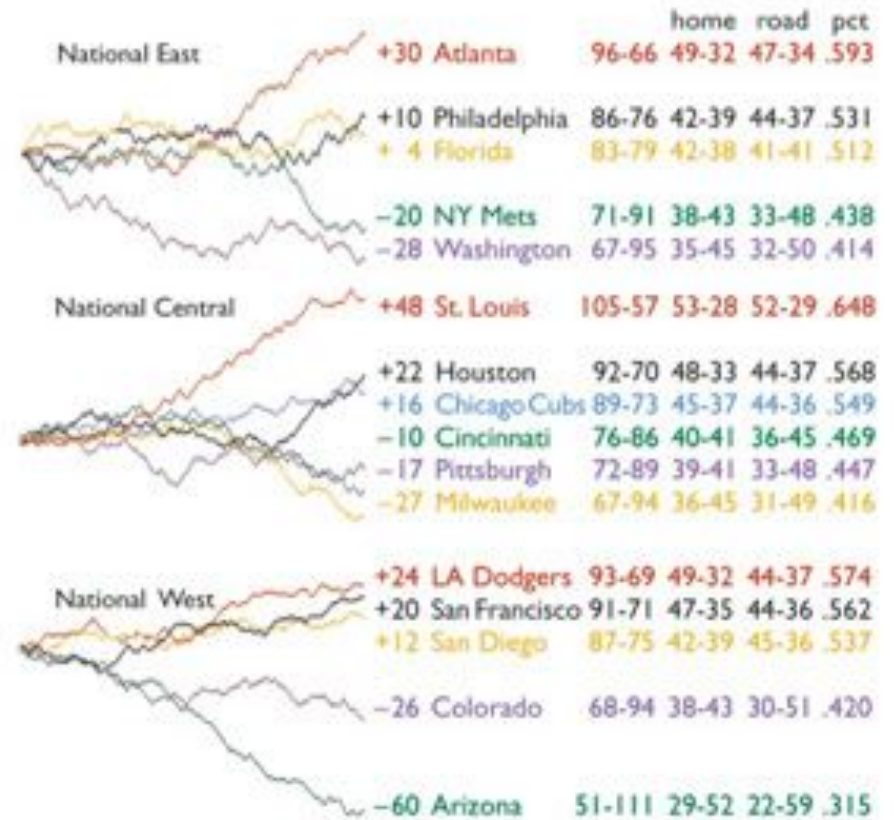
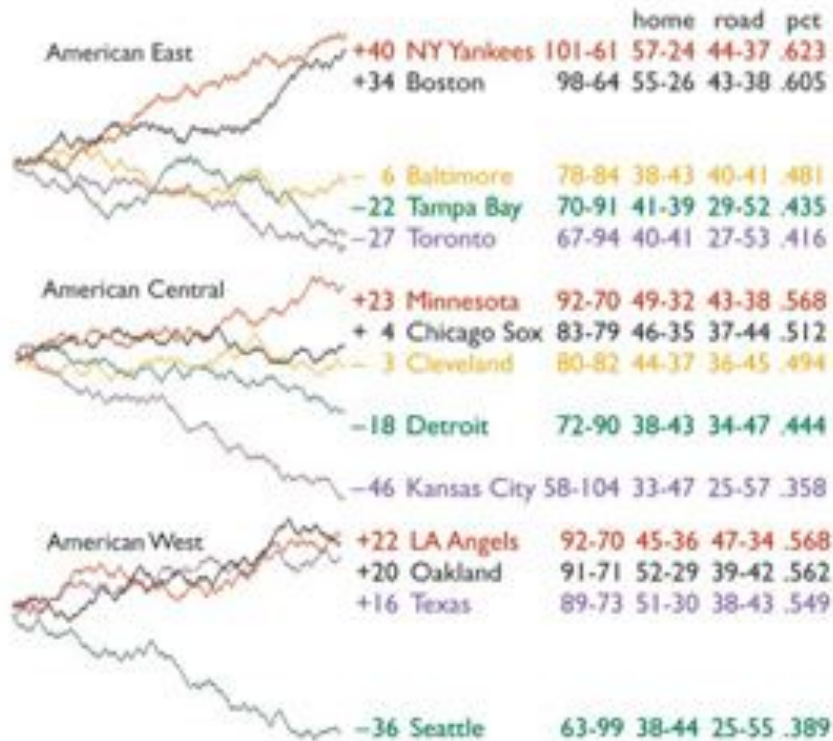


# Some of Tufte's Favorite Visualizations

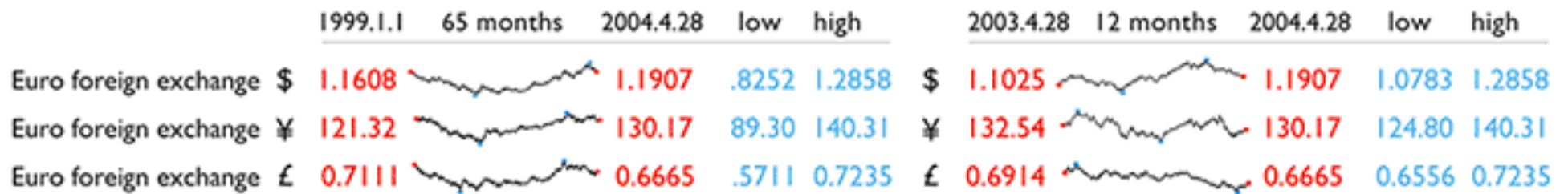
## National League West: 2012



# Some of Tufte's Favorite Visualizations



# Some of Tufte's Favorite Visualizations



Current Receipts of Government as a Percentage of Gross Domestic Product, 1970 and 1979





## Tufte Principles

**Above all else, show the data.**

Maximize the data-ink ratio.

Erase non-data-ink

Erase redundant data-ink.

Revise and edit

## Visual Cues

Position

Length

Angle

Direction

Shapes

Area or Volume

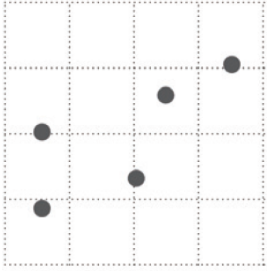
Color

## Visual cues

When you visualize data, you encode values to shapes, sizes, and colors.

### Position

Where in space the data is



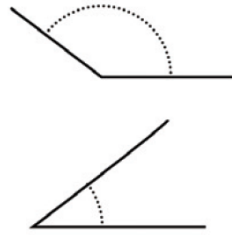
### Length

How long the shapes are



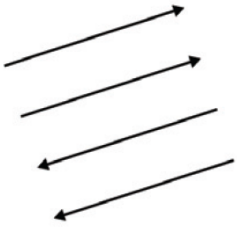
### Angle

Rotation between vectors



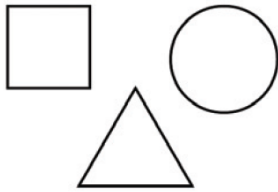
### Direction

Slope of a vector in space



### Shapes

Symbols as categories



### Area

How much 2-D space



### Volume

How much 3-D space



### Color saturation

Intensity of a color hue



### Color hue

Usually referred to as color



FIGURE 3-3 Visual cues

# Visual cues

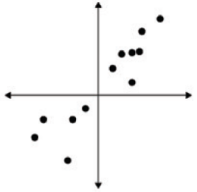

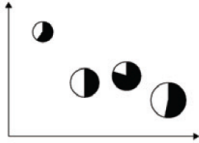

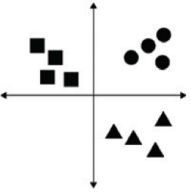
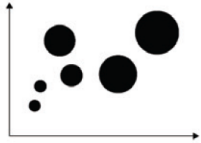
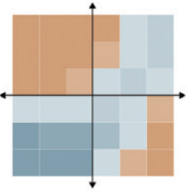
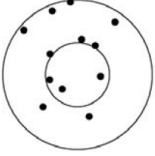


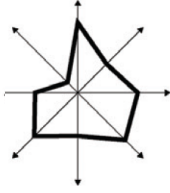
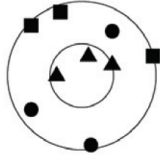









	Position	Length	Angle	Direction	Shapes	Area or Volume	Color
Coordinate systems							
Polar							
Geographic							

FIGURE 3-25 Visualization component combinations

Principles from Nathan Yau

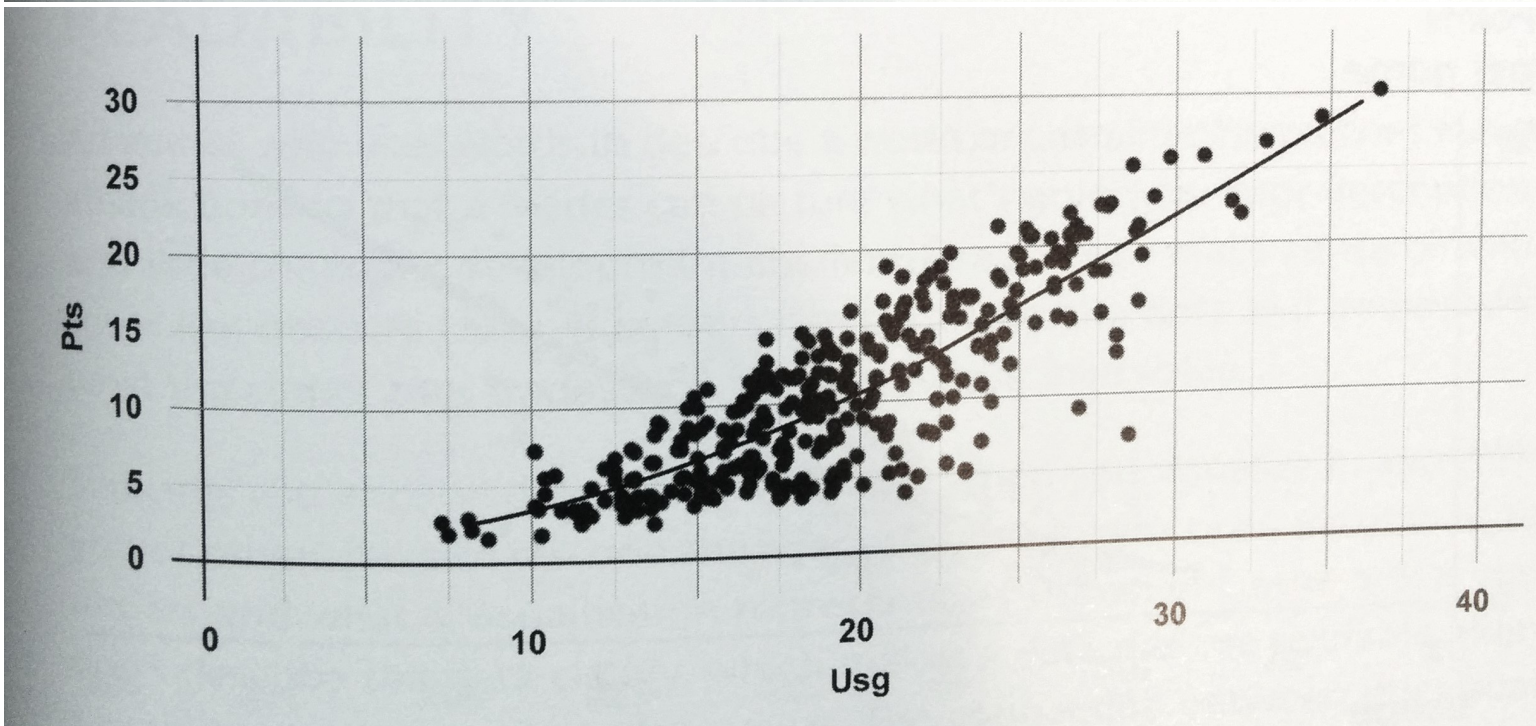
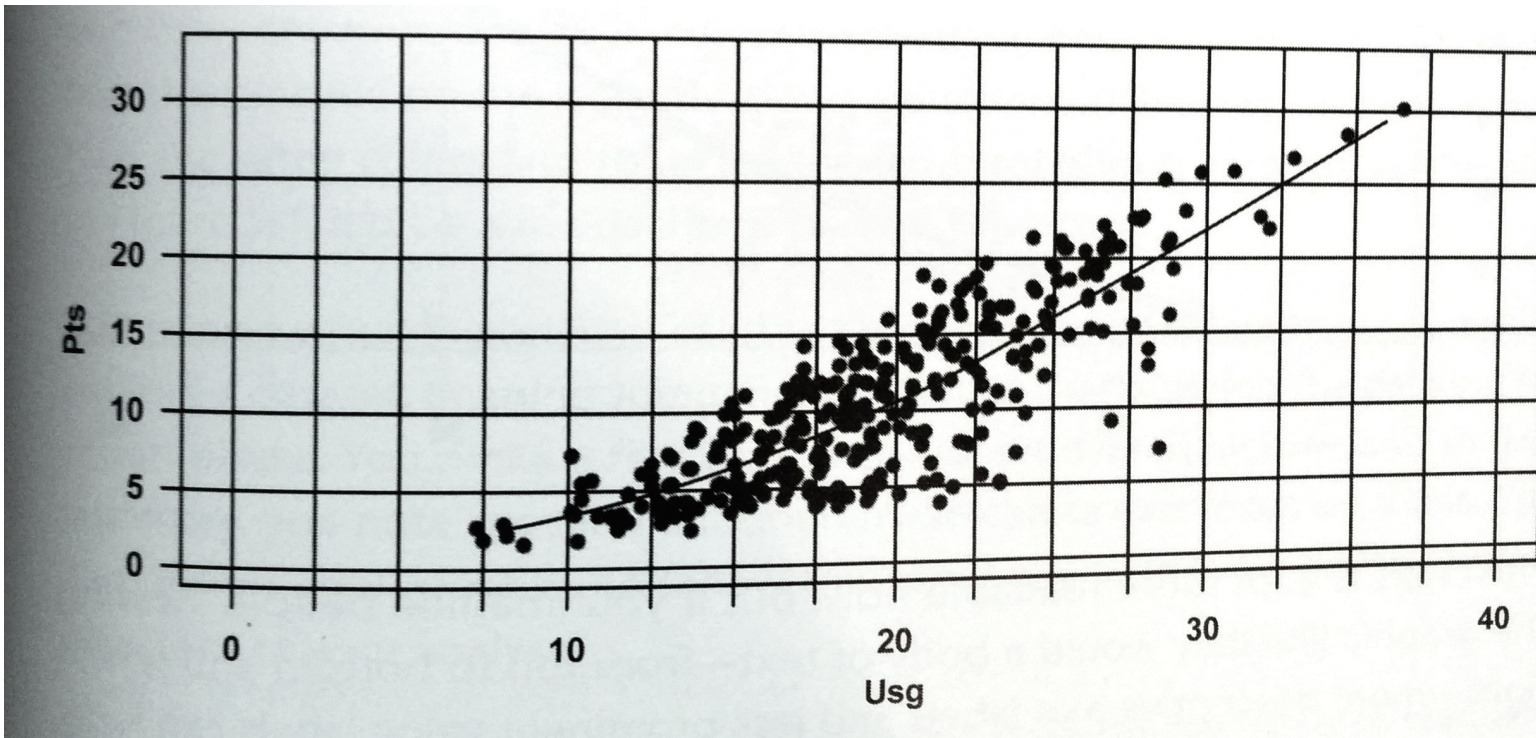
Visual Hierarchy

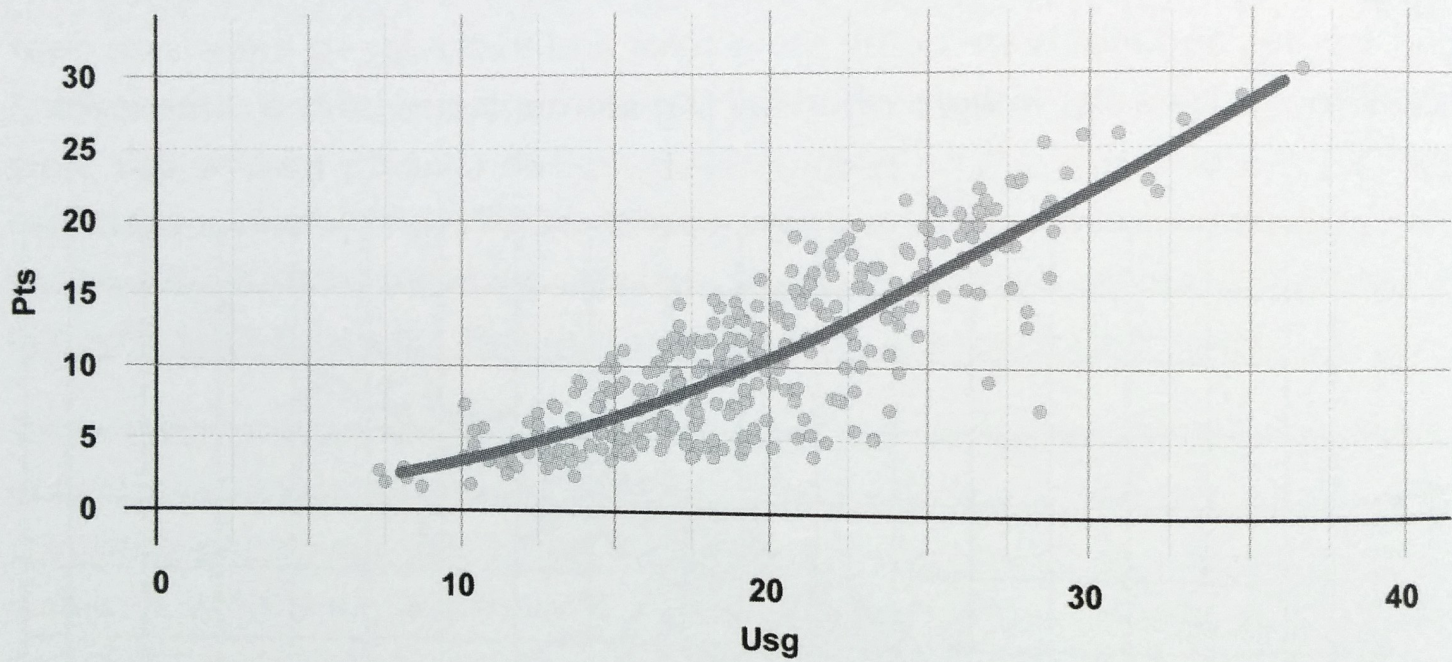
Readability

Highlighting to Guide Readers Through

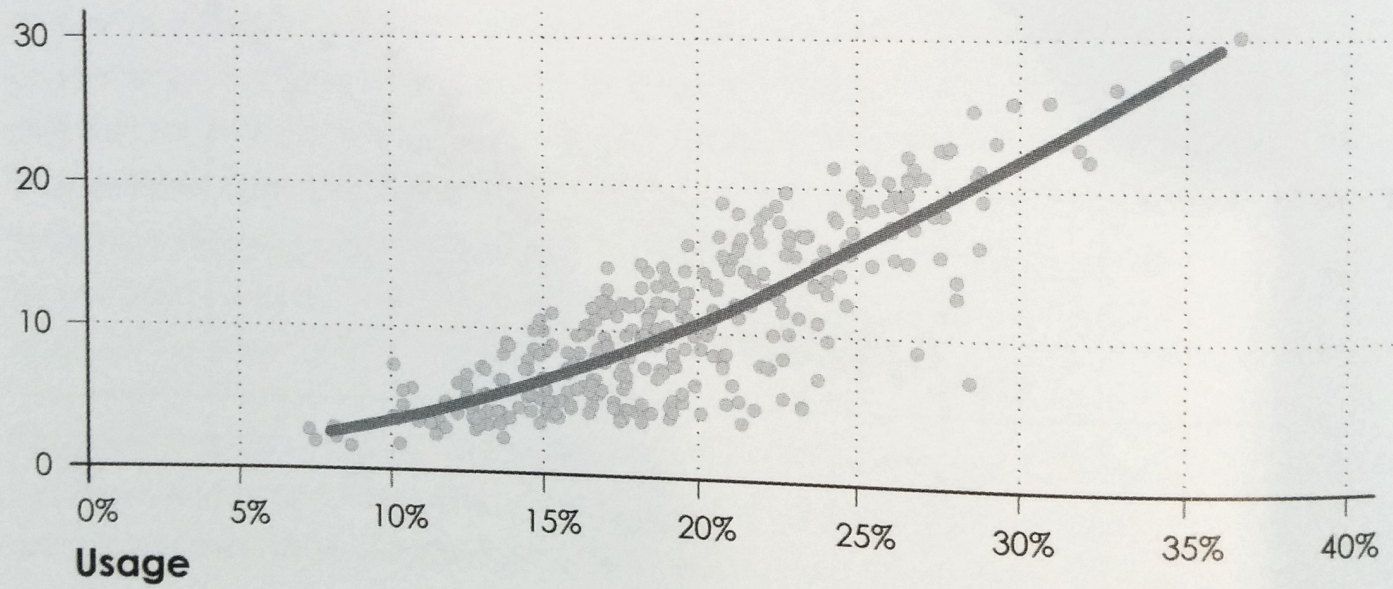
Annotation to Explain the Data

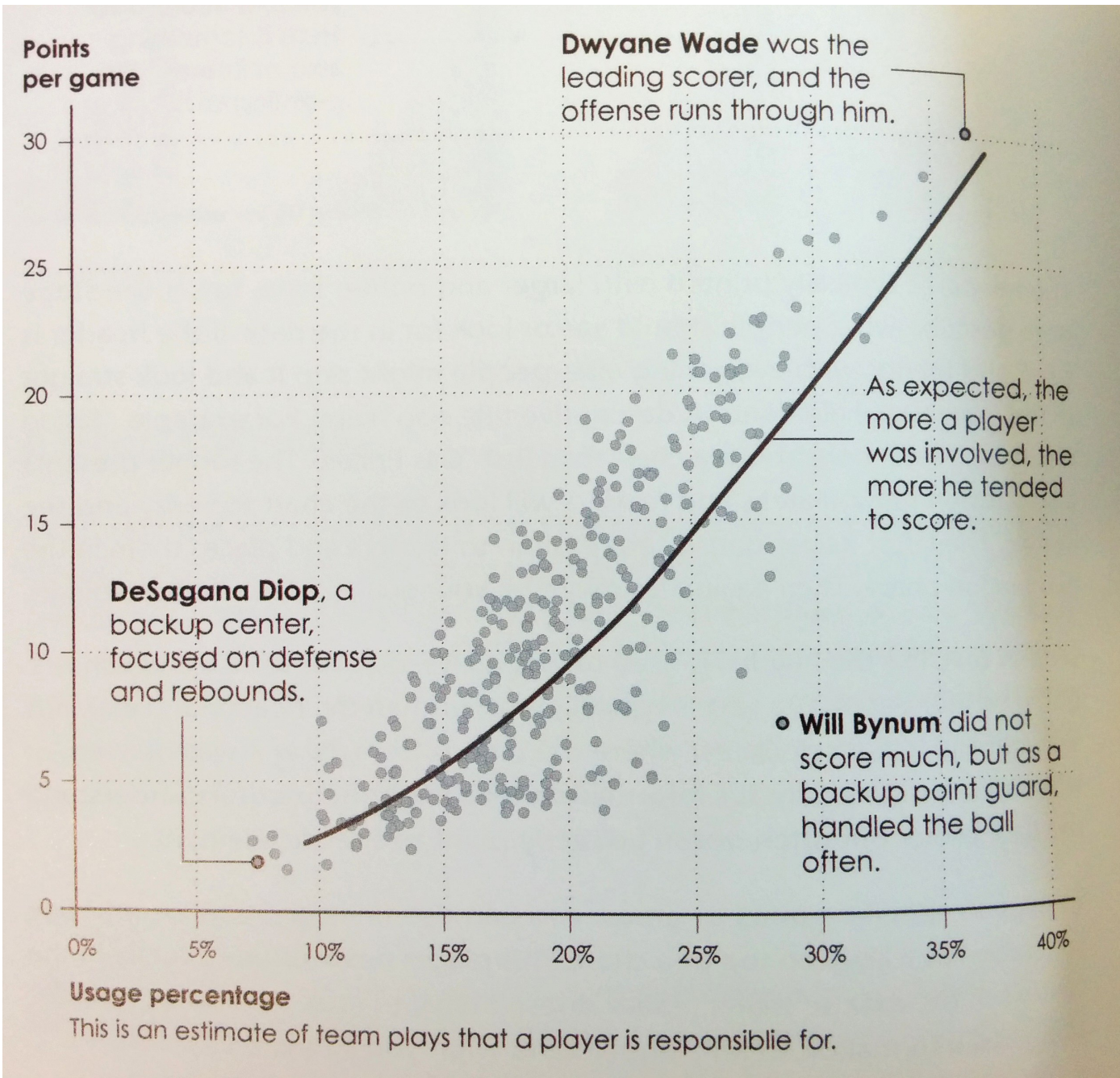
Do The Math





Points per game







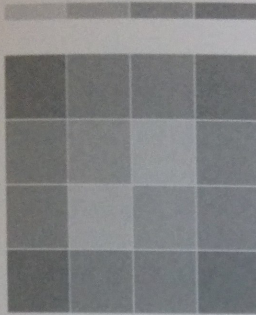
### Harder to Compare

### Easier to Compare

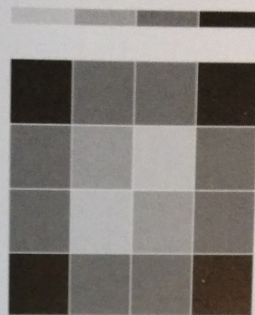
#### Narrow color scale

#### Wide color scale

Colors look washed out and pattern is less obvious.



vs.

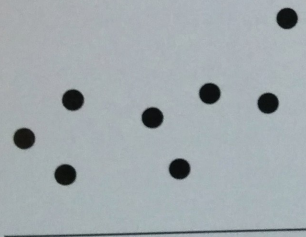


Greater contrast between bins makes pattern obvious.

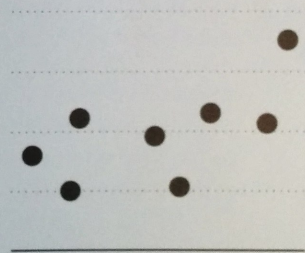
#### Showing data points only

#### Additional visual elements

It's harder to compare positions as you scan across.



vs.

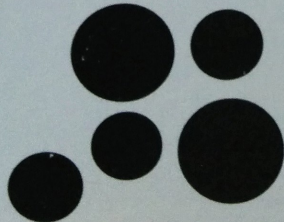


Line increments make comparison quicker.

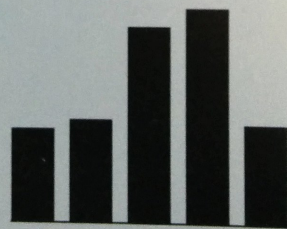
#### Using area as visual cue

#### Using length as visual cue

Although area has its merits, it can be hard to see small differences.



vs.



Small differences are easier to see without a square root transform.

FIGURE 5-7 Allowing comparisons